Naval Biomedical Research and Development

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Biomedical Research

Medicine is critical for:

- Saving lives
- Optimizing performance
- Maintaining combat readiness
- Reducing logistics burden

Care under fire in Operation Enduring Freedom

Biology is critical for:

- Detecting emerging threat agents
- Harvesting energy for power supplies
- Preventing disease
- Locating unexploded ordnance in littorals

Green Synthesis of Hellfire missile propellant

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Medical Challenges in Transformation

Operational Impacts to Medical Support

- Shift in medical capability from shore to sea base
  - Elimination of fixed, shore based “middle levels of care”
  - Increased time/distance from injury to definitive care
- Reduced footprint and logistic drag and increased effectiveness
- Support full spectrum of conflict intensities/novel threats

Required Medical Capabilities

- Optimize physical and cognitive performance
- Conserve personnel availability by reducing disease and non-battle injury
- Self aid/buddy aid techniques
- Enable injured warfighters to remain tactical/avoid evacuation
- Improve medical self reliance of maneuver units to stabilize casualties and prepare for transport
- Enhanced transport of unstable casualties over long distances (200NM)

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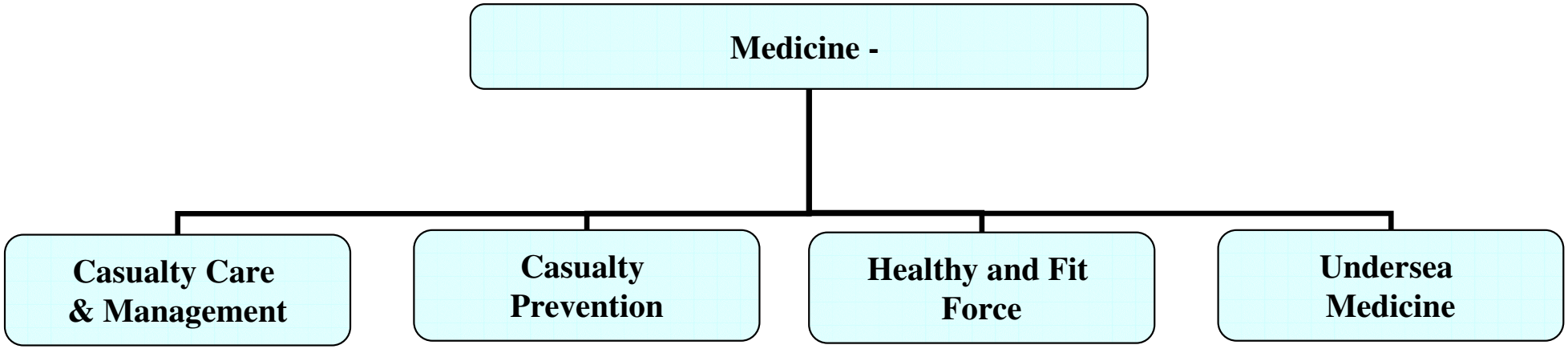
Medicine Overview



- Hemostasis
- Resuscitation
- Medical devices
- Analgesics
- Casualty informatics
- Radiation injury treatment

- Directed energy
- Performance in extreme environments
- Spatial disorientation
- Stress physiology
- Toxicology and infectious diseases

- Musculoskeletal injury prevention
- Hearing loss

- Decompression illness
- Hyperbaric oxygen toxicity

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Casualty Care & Management

Focus: Eliminate preventable deaths by creating improved methods for treatment of battlefield injuries.

Products:

- Methods to control external and internal bleeding
- Low volume resuscitation fluid
- Oxygen delivery mask
- Transport ventilator
- Devices to monitor/track casualties and assess resuscitation status
- Morphine substitute
- Combat trauma registry

Corpsman administering resuscitation fluid to casualty in Operation Iraqi Freedom

Customers: USMC, USN, other Services, law enforcement agencies, and civil emergency response personnel

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Casualty Prevention

Focus: Counter threats from disease, battle and non-battle injuries

Products:

- Eye protection against agile laser threats and laser incident detection
- Diving/damage control/firefighting/aircrew suits
- Blunt trauma and thermobaric injury models
- Noninvasive technologies for disease detection
- Protection against effects of environmental stressors
- Characterization of biological effects of directed energy weapons
- Tools to identify warfighters with high resistance to stress and its impairing effects

Customers: USMC, OPNAV, NAVSEA, JSF, DoD Joint Non-Lethal Weapons Directorate, Army

Tactical Laser Systems

Active Denial Systems

Workload-induced stress

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Healthy & Fit Force

Focus: Preserve health and fitness of ready forces

Products: Tools and techniques to prevent, treat, or alleviate injuries caused by normal activities endemic to the military work environment

Customers:

- NAVAIR, NAVSEA, SOCOM

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Undersea Medicine

Focus: Predict, prevent, and treat adverse effects of Naval operations in undersea environments.

Products: Knowledge base, tools, procedures, and guidance for safe and effective undersea operations

Customers:

- NAVSEA, N773, SUBLANT, SUBPAC, PACFLT, LANTFLT, SOCOM, BUMED, USMC
- USAF, USA, NASA
- NATO

Undersea Naval Operations

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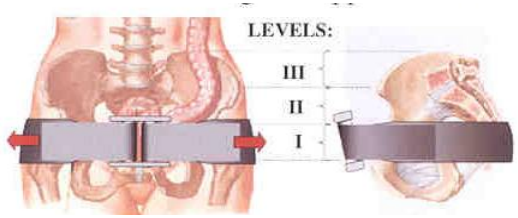
Examples of Navy – Industry Partnerships

- **QuikClot: Z-Medica, CT**
  - Credited with saving at least 19 lives in OIF
  - Stops uncontrolled bleeding
  - Cost per package: $9.85

- **Handheld ultrasound diagnostic system: Sonosite, WA**
  - Allows for unprecedented far forward diagnostic imaging to support triage, treatment and evacuation decisions
  - Used at USMC Shock Trauma Platoon and Surgical Companies
  - Over 300 systems deployed

- **Pelvic Sling: The Seaberg Company, OR**
  - Fixation device for pelvic fracture
  - Prior to this device, immediate surgical intervention was the only life saving method of treatment
  - Reduces internal bleeding
  - Facilitates safe transport



Strategic New Interest Areas

- Wound management
- Prevention of aviation mishaps
- Neurological effects of blast
- Warfighter mental health
- Head, face and neck protection
- Extremity protection
- Decision support tools for predicting DNBI
- Prediction of heat casualties
- Prevention of musculoskeletal injury

Biosensors, Biomaterials & Bioprocesses

Problems:

- Costly manufacturing of Naval materials
- Warfighter vulnerability to multi-drug resistant pathogens
- Current hand-held biosensors do not meet operational needs
- Difficulty locating underwater unexploded ordnance (UXO) in littorals
- Coastal environmental compliance issues impact operational readiness.
  - Aquatic ranges (corroding UXO)
  - Ship/shore contaminants
- Inability to indefinitely power unattended sensor networks
- Inability to predict coastal water optical properties impedes stealthy amphibious operations

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Biosensors, Biomaterials & Bioprocesses

Focus: Bio-based capabilities to support the Naval warfighter and reduce operating costs

Products:

- Cost-driven "green" synthesis of energetic materials
- Novel antibiotics to combat multi-drug resistant pathogens & BW threat agents
- Self-contained, multi-analyte, stable biosensors
- AUVs for littoral UXO detection
- Organic-powered biofuel cells
- Environmentally compliant ship hull coatings
- UXO mitigation in coastal zone
- Defensible scientific data for Navy policy development

Green synthesis of Hellfire missile propellant

Customers:

- N093, N096, N7, PMS EOD, N45, NAVFAC, PEO LMW, NAVSEA, 05M, MEF, REC, BUMED, NOAA, NATO, USAMRMC, NIAID, NSWC-IH, DARPA, JSTPCBD
- Marine paint industry
- Pharmaceutical industry

AUV with TNT sensor and plume tracking analyzer

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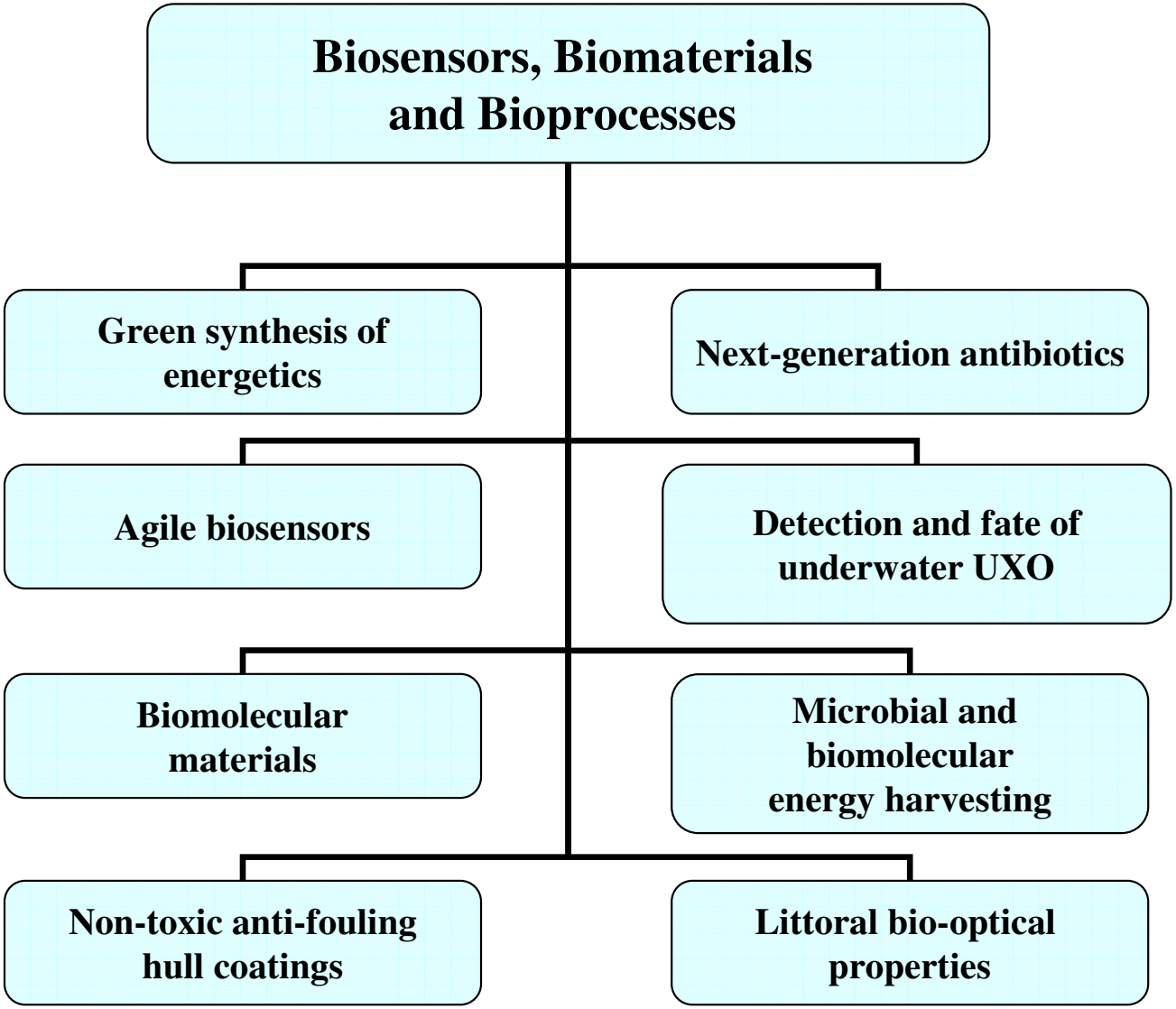
Biology Overview



Funding Philosophy

- Where do our research dollars go:
  - Basic Research (6.1) – Universities and Naval Laboratories
  - Advanced Research (6.2) – Naval Laboratories and Industry
  - Applied Research (6.3) – Industry and Naval Laboratories
- How do they compete for those dollars:
  - Broad Agency Announcements – Long range and specific
  - Small Business Innovation Research (SBIR)